ST. GEORGE'S SCHOOL, ALAKNANDA

MID TERM EXAMINATION [2017-18]

SUBJECT: MATHEMATICS

CLASS- XI

Date: 16.9.17

Max Marks : 100

Time:- 3hrs

No. of pages : 03

General Instructions:-

(i) All questions are compulsory.

(ii) The question paper consists of 29 questions divided into four sections. **Section –A** comprises of 4 questions of 1 mark each. **Section –B** comprises of 08 questions of 02 marks each **Section – C** comprises of 11 questions of 04 marks each and **Section D** comprises of 06 questions of 06 marks each.

(iii) There is no overall choice.

Section : A

Q1. Write the power set of $\{0, \emptyset, \{\emptyset\}\}$.

Q2. Write the following set in the Roaster Form.
$A = \{x : x \text{ is a positive integer less than } 10 \text{ and } 2^x - 1 \text{ is an odd number}\}$.

Q3. Find Multiplicative Inverse of $-i$.

Q4. Find the r^{th} term in the expansion of $(x + \frac{1}{x})^{2r}$.

Section : B

Q5. Find the domain for which the functions $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal.

Q6. Evaluate $(1+i)^6 + (1-i)^3$

Q7. Solve $|5 - 2x| < 1$, $x \in R$ and represent the solution set on number line.

Q8. If $n_{C_8} = n_{C_2}$ find n_{C_2}

Q9. State and prove De-morgan's Law.

Q10. In how many ways can a student choose a programme of 5 courses if 9 courses are available and 2 specific courses are compulsory for every student.

Q11. Find the smallest positive integer for which $(1+i)^{2n} = (1-i)^{2n}$.

Q12. Prove that $\frac{Sin\,(x+\theta)}{Sin\,(x+\emptyset)} = \text{Cos}\,(\theta-\emptyset) + \text{Cot}\,(x+\emptyset)\,\text{Sin}(\theta-\emptyset)$

Section : C

Q13. In how many ways can 5 children be arranged in a line such that: -

(i) Two particular children of them are always together.
(ii) Two children of them are never together.

Q14. Write the polar form of the complex number $(i^{25})^3$?

Q15. Find the value of $(\sqrt{3}\,\text{Cosec}\,20^0 - \text{Sec}\,20^0)$.

Q16. Solve $\sqrt{3}\,\text{Cos}\,\theta + \text{Sin}\,\theta = \sqrt{2}$

Q17. Solve using Principle of Mathematics Induction for $n \in N$.
$1+2+3+\text{---------}+n < \frac{1}{8}(2n+1)^2$.

Q18. Find the real values of x and y for which the following equalities hold :
$(x^4 + 2xi) - (3x^2 + iy) = (3-5i) + (1+2iy)$.

Q19. Find the 4^{th} term from the end in the expansion of $\left(\frac{x^3}{2} - \frac{2}{x^2}\right)^9$.

Q20. In a survey it was found in a certain locality, 21 persons like Chinese food, 26 South Indian and 29 Punjabi food. 14 like Chinese and South Indian both. 15 like South Indian and Punjabi both while 12 like Punjabi and South Indian and 8 persons like all the three types of food. Find the number of persons for which the survey has been conducted.

Q21. Find the term independent of x in the expansion of $\left(\frac{\sqrt{x}}{\sqrt{3}} + \frac{\sqrt{3}}{2x^2}\right)^{10}$.

Q22. Find $\boldsymbol{\theta}$ if $3\tan(\boldsymbol{\theta} - 15^0) = \tan(\boldsymbol{\theta} + 15^0)$ where $0^0 < \boldsymbol{\theta} < 90^0$.

Q23. Find the domain and range of : -

a) $f(x) = \frac{x^2-16}{x-4}$ b) $f(x) = \sqrt{x-1}$

Section : D

Q24. Find the value of $2x^4 + 5x^3 + 7x^2 - x + 41$ when $x = -2 - \sqrt{3}\, i$.

Q25. Solve the following system of equations graphically $4x + 3y \leq 60, y \geq 2x, x \geq 3, y \geq 0$.

Q26. Find the value of $(1 + \cos\frac{\pi}{8})(1 + \cos\frac{3\pi}{8})(1 + \cos\frac{5\pi}{8})(1 + \cos\frac{7\pi}{8})$.

Q27. Find n if the coefficients of 5^{th}, 6^{th} and 7^{th} terms in the expansion of $(1+x)^n$ are in A.P..

Q28. If $x \cos\theta = y \cos(\theta + \frac{2\pi}{3}) = z \cos(\theta + \frac{4\pi}{3})$, then find the value of $xy + yz + zx$.

Q29. Prove that : -

a) $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$

b) $\frac{Sec\ 8\theta - 1}{Sec\ 4\theta - 1} = \frac{tan\ 8\theta}{tan\ 2\theta}$